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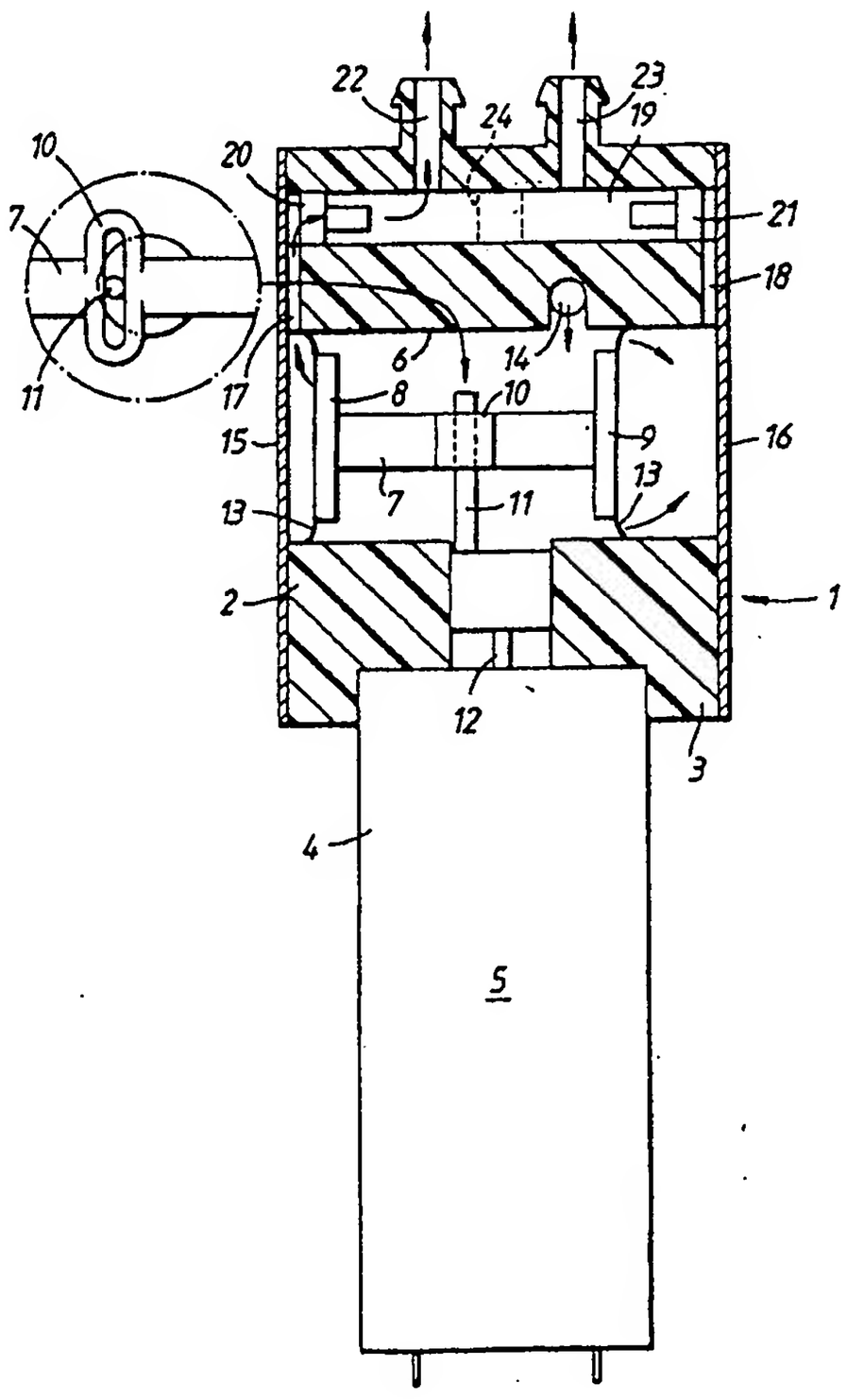
(54) Inflation pump

(57) A pump (1) for inflating the lumbar support of a motor vehicle seat comprises a moulded plastics body (2) having a bore (6) in which is housed a double ended piston member (7) having cup seals 13. The piston member (7) is reciprocated by a motor (5) which has an eccentric pin (11) engaged in a yoke (10) of the piston member. Air enters the space between the seals via an aperture (14) and is forced by the reciprocating piston member through outlet valves (20,21) to an outlet chamber (19) for delivering to the lumbar support.

If required a partition (24) may be provided to separate the outlets (22,23).



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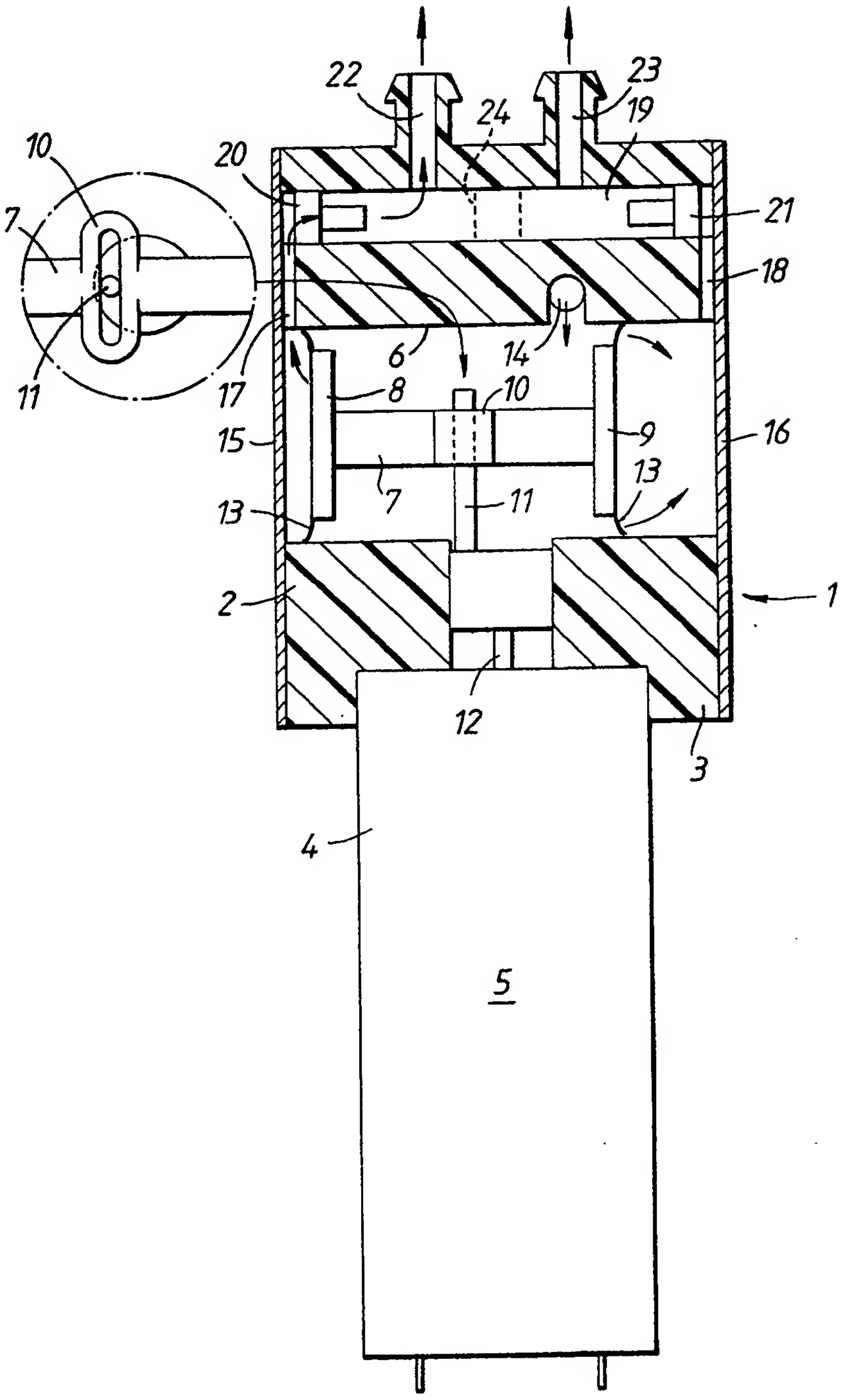

SPECIFICATION

Inflation pump

This invention relates to an inflation pump suitable for an inflatable lumbar support of a motor vehicle seat.

It is well known to provide the lumbar region of the seat of a motor vehicle with an inflatable support cushion which can be selectively inflated by a user of the seat to meet his particular requirement for lumbar support.

The means provided for inflating the cushion must meet certain critical criteria. Notably, the inflation device must be capable of providing air at an appropriate pressure and at an appropriate volume to allow for accurately controlled inflation of the cushion. It must be small and light so as not to add undesirably to the bulk and weight of the seat installation, it must be capable of operating over the full temperature range to which the vehicle may be subject, and it must have a life expectancy comparable with that of other components of the motor vehicle.

In order to meet the requirements outlined above it has been conventional to use a hand operated bulb for the purpose of inflating lumbar supports. Patent specifications GB 2092439, GB 2140294, and EP 0033225 illustrate the proposed use of a hand operated bulb. Whilst such devices perform satisfactorily, the increasing sophistication of motor car specifications has lead to a desire to mechanise the inflation of lumbar supports.

The object of the present invention is to provide an electric pump, suitable for inflation of an inflatable cushion of a motor vehicle seat, which is small, quiet, of light weight, and which can be manufactured economically making extensive use of moulded plastics components.

According to the present invention there is provided a pump for inflation of an inflatable lumbar support of a motor vehicle seat, the pump comprising: a piston member reciprocable in a bore which is closed at both ends, the piston member having a pair of heads at the opposite ends thereof; an electric motor having a crank pin connected to the output shaft thereof, the crank pin being coupled to the piston member intermediate the heads whereby the piston member is reciprocated in the bore upon rotation of the electric motor; a flexible cup seal on each piston head, each cup seal being operative sealingly to engage the bore during each forward pressure generating, stroke of the associated head and to permit the flow of air between the cup seal and the bore during each return stroke of the associated head; an inlet passage establishing communication between the zone of the bore located between the seals and atmosphere; and a pair of outlet passages each housing a non-return valve, each outlet passage establishing communication between the bore at a respective closed end thereof and a pump outlet.

The use of cup seals is particularly advantageous in that it permits the pump to operate satisfactorily over the wide temperature range likely to be encountered, and obviates the need to provide a separate inlet valve. Further, because the cup seals are able to accommodate dimensional changes of the pump component due to thermal expansion and contraction, the majority of the components of the pump can be manufactured from plastics material by injection moulding, thereby keeping the weight and cost of the pump to an acceptable level.

The outlet passages may serve a common pump outlet, in which case the outlet passages down stream of the non-return valves preferably combined form a single chamber to which the pump outlet is connected. In the alternative, the outlet passages may be connected to separate pump outlets to provide sources of compressed air to two separate components.

Various features and advantages of the invention will become clear from the following description of a preferred embodiment thereof, given by way of example only, reference being had to the accompanying drawing wherein the single Figure shows schematically a cross-section of a preferred embodiment of pump in accordance with the present invention.

The pump 1 as shown in the drawing comprises a body 2 injection moulded from a suitable plastics material, e.g. an acetal co-polymer. The body includes a split skirt 3 which may be tightened by means of a suitable clamp around the body 4 of an electric motor 5 in order to mount the pump body on the electric motor.

A main bore 6 is formed in the body 2 and houses a piston member 7 having respective heads 8, 9 at opposite ends thereof. Intermediate the heads 8, 9 the piston member is formed with a yoke 10 in which is received a crank pin 11 connected eccentrically to the motor output shaft 12. Accordingly, rotation of the motor output shaft 12 causes the piston member 7 to reciprocate within the bore 6 through a stroke determined by the throw of the crank pin 11.

Each piston head 8, 9 carries a cup seal 13. the peripheral sealing lip of each cup seal resiliently engages the bore 6 so that during the pressure generating stroke of a head the associated cup seal sealingly engages the wall of the bore 6. The zone of the bore 6 located between the seals 13 is in communication with atmosphere via a port 14. Preferably, the port 14 is fitted with a dust excluding filter, e.g. a mass of sintered polyethylene granules.

The opposite ends of the bore 6 are closed by end plates 15, 16 which are sealingly connected to the body 2 by any suitable means.

Outlet passages 17, 18 are formed between the body 2 and the end plates 15, 16 and connect respective closed ends of the bore 6 to an outlet chamber 19. Each passage 17, 18, incorporates a non-return valve 20, 21 respectively. The valves 20, 21 may be of any convenient form, for example moulded rubber flap valves.

Two outlet fittings 22, 23 are provided to permit the connection of tubing to the pump as described hereinafter.

In use, the motor 5 is energised to rotate the shaft 12 and reciprocate the piston member 7 as hereinbefore described. As each head 8, 9 moves towards its adjacent end plate 15, 16 the respective cup seal 13 sealingly engages the bore and air is displaced along a respective passage 17, 18 and through a respective valve 20, 21 into the chamber 19. Since the heads 8, 9 alternate in their movement towards their associated end plates a double-acting pumping action is provided.

As each head 8, 9 moves away from its associated end plate during a return stroke the associated cup seal 13 flexes away from the bore 6 to permit air to flow past the cup seal into the closed end portion of the bore.

The cup seals may be formed integrally with the piston member 7, or may be provided as separate seals mounted on the piston member 7. In the preferred embodiment of the invention the piston member 7 is an acetal copolymer injection moulding and the cup seals are injection moulded from polyurethane.

In a preferred use circuit the outlet 22 is connected by tubing to a lumbar support cushion and the outlet 23 is connected to an electropneumatic valve. By closing the valve and energising the motor 5 air may be delivered to inflate the support cushion. By deenergising the motor 5 and opening the electropneumatic valve air may flow from the cushion back through fitting 22 into outlet chamber 19 and thence via outlet 23 to the electropneumatic valve and to atmosphere.

In a modified embodiment of the invention a partition 24 as indicated in broken lines in the drawing is formed in the chamber 19, dividing the chamber into separate parts respectively served by one of the piston head and cup seal assemblies. The outlets 22, 23 can then be used to supply compressed air to two separate use circuits.

Because the cup seals 13 are well able to accommodate changes in dimensions of components of the pump due to thermal expansion and contraction, it has been found that a pump as described above is well able to operate over the extreme operating temperature which must be provided for. Despite this ability to operate over a wide range of operating temperatures the pump can be made from an assembly of plastics mouldings.

The pump offers the further advantage that the output of the pump can readily be adjusted merely be changing the throw of the crank pin 11, and thus pumps having an output tailored to the particular needs of a particular vehicle can readily be produced merely by selecting the desired throw for the crank 11. Further, the unswept volume of the pump can be altered by changing the end plates 15, 16 to provide either some incursion into the illustrated unswept volume, or some additional unswept volume at the ends of the bore 6. By altering the ratio of swept to unswept volume the compression ratio of the pump may be varied at will to meet particular design criteria.

The above described embodiment of the invention offers an electric air pump to provide inflation by a method in keepting with the increasing sophistication of motor car specifications. The design takes advantage of plastics technology and moulding techniques to create an electrically operated air pump which is small and quiet enough to be fitted into the seat itself, and is engineered to meet the performance and life cycle requirements of an automotive component.

Whilst the pump has been described with particular reference to the inflation of a lumbar support cushion, it will be appreciated that it may be used for other purposes, either as an inflation pump or as a source of compressed gas for other uses.

CLAIMS

1. A pump for inflating an inflatable lumbar support of a motor vehicle seat, the pump comprising: a piston member reciprocable in a bore which is closed at both ends, the piston member having a pair of heads at the opposite ends thereof; an electric motor having a crank pin connected to the output shaft thereof, the crank pin being coupled to the piston member intermediate the heads whereby the piston member is reciprocated in the bore upon rotation of the electric motor; a flexible cup seal on each piston head, each cup seal being operative sealingly to engage the bore during each forward pressure generating, stroke of the associated head and to permit the flow of air between the cup seal and the bore during each return stroke of the associated head; an inlet passage establishing communication between the zone of the bore located between the seals and atmosphere; and a pair of outlet passages each housing a non-return valve, each outlet passage establishing communication between the bore at a respective closed end thereof and a pump outlet.

2. A pump according to claim 1 comprising a pump body in which the bore is defined, the pump body being moulded from plastics material.

3. A pump according to claim 2 wherein the bore is closed at each end by a respective end plate which is sealingly secured to the

pump body.

4. A pump according to claim 3 wherein the end plates protrude into the bore.

5. A pump according to claim 3 wherein the end plates define a space contiguous with and outside of the bore.

6. A pump according to any of claims 2 to 5 wherein the body has a skirt which is tightened around the motor to secure the motor to the body.

7. A pump according to any preceding claim wherein the piston member is a plastics moulding.

8. A pump according to any preceding claim wherein the outlet passages downstream of the non-return valves are connected to a common chamber to which the pump outlet is connected.

9. An inflation system for an inflatable lumbar support of a motor vehicle seat, the system comprising: the pump of claim 8; a first length of tubing connected to the common chamber and to the lumbar support; and a second length of tubing connected to the common chamber and to a valve, whereby closing the valve and energising the motor causes air to be delivered to the lumbar support to inflate the support, and de-energising the motor and opening the valve permits air to flow from the support, through the first length of tubing, the common chamber, the second length of tubing and the valve to atmosphere.

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